

What is claimed is:

1. A process for combined chemically cleaning and etching parts made of aluminum and/or aluminum alloys comprising:

(a) providing a cleaning and etching solution comprising:

- 5 (1) 5-35 grams/liter of phosphoric acid;
- (2) 5-35 grams/liter of hydrogen fluoride;
- (3) 55-95 grams/liter of sulfamic acid;
- (4) 55-95 grams/liter of glycol ether; and
- (5) balance water;

- 10 (b) contacting said parts with said solution for a time sufficient to achieve the desired amount of cleaning and etching;
- (c) periodically measuring the etching rate of said solution to determine if the etching rate is at or above the required minimum rate;
- (d) when the etching rate is below the required minimum rate, adding sufficient
- 15 hydrogen fluoride to restore the etching rate above the required minimum rate; and
- (e) periodically adding sufficient sulfamic acid to prevent the formation of scale made of hydrated aluminum fluoride.

2. The process of Claim 1, paragraph (d), wherein the amount of hydrogen fluoride

20 added is 0.5-1.3 grams per liter.

3. The process of Claim 1, paragraph (e), wherein the amount of sulfamic acid added is 7-28 grams per liter.

4. The process of Claim 1, wherein the starting amount of phosphoric acid is 25-35 grams per liter.

25 5. The process of Claim 1, wherein the starting amount of hydrogen fluoride is 25-35 grams per liter.

6. The process of Claim 1, wherein the starting amount of sulfamic acid is 80-95 grams per liter.

7. The process of Claim 1, wherein the starting amount of glycol ether is 80-95 grams per liter.

8. The process of Claim 1, wherein the glycol ether is propylene glycol monomethyl ether.

5 9. The process of Claim 1, wherein the process is run at ambient temperature.

10. A process for combined chemically cleaning and etching parts made of aluminum and/or aluminum alloys comprising:

(a) providing a cleaning and etching solution comprising:

(1) 5-35 grams/liter of phosphoric acid;

10 (2) 5-35 grams/liter of hydrogen fluoride;

(3) 120-220 grams/liter of sulfamic acid;

(4) 55-95 grams/liter of glycol ether; and

(5) balance water;

15 (b) contacting said parts with said solution for a time sufficient to achieve the desired amount of cleaning and etching;

(c) periodically measuring the etching rate of said solution to determine if the etching rate is at or above the required minimum rate;

20 (d) when the etching rate is below the required minimum rate, adding sufficient hydrogen fluoride to restore the etching rate above the required minimum rate; and

(e) periodically adding sufficient sulfamic acid to prevent the formation of scale made of hydrated aluminum fluoride.

11. The process of Claim 10, paragraph (d), wherein the amount of hydrogen fluoride added is 0.5-1.3 grams per liter.

25 12. The process of Claim 10, paragraph (e), wherein the amount of sulfamic acid added is 7-28 grams per liter.

13. The process of Claim 10, wherein the starting amount of phosphoric acid is 25-35 grams per liter.

14. The process of Claim 10, wherein the starting amount of hydrogen fluoride is 25-35 grams per liter.
15. The process of Claim 10, wherein the starting amount of sulfamic acid is 120-130 grams per liter.
- 5 16. The process of Claim 10, wherein the starting amount of glycol ether is 80-95 grams per liter.
17. The process of Claim 10, wherein the glycol ether is propylene glycol monomethyl ether.
18. The process of Claim 10, wherein the process is run at ambient temperature.
- 10 19. A process for combined chemically cleaning and etching parts made of aluminum and/or aluminum alloys comprising:
- (a) providing a cleaning and etching solution comprising:
- (1) 25-35 grams/liter of phosphoric acid;
- (2) 25-35 grams/liter of hydrogen fluoride;
- 15 (3) 120-130 grams/liter of sulfamic acid;
- (4) 80-95 grams/liter of propylene glycol monomethyl ether; and
- (5) balance water;
- (b) contacting said parts with said solution for a time sufficient to achieve the desired amount of cleaning and etching;
- 20 (c) periodically measuring the etching rate of said solution to determine if the etching rate is at or above the required minimum rate;
- (d) when the etching rate is below the required minimum rate, adding 0.5-1.3 grams of hydrogen fluoride; and
- (e) periodically adding 7-28 grams per liter of sulfamic acid.
- 25 20. The process of Claim 19, wherein the process is run at ambient temperature.
21. A solution for combined chemically cleaning and etching parts made of aluminum and/or aluminum alloys comprising:
- (a) 5-30 grams/liter of phosphoric acid;

- (b) 5-30 grams/liter of hydrogen fluoride;
- (c) 120-220 grams/liter of sulfamic acid;
- (d) 55-85 grams/liter of glycol ether; and
- (e) balance water.

5        22. The solution of Claim 21, wherein the amount of phosphoric acid is 25-35 grams per liter.

23. The solution of Claim 21, wherein the starting amount of hydrogen fluoride is 25-35 grams per liter.

10       24. The solution of Claim 21, wherein the starting amount of sulfamic acid is 120-130 grams per liter.

25. The solution of Claim 21, wherein the starting amount of glycol ether is 80-95 grams per liter.

15       26. The solution of Claim 21, wherein the glycol ether is propylene glycol monomethyl ether.